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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,626	06/20/2001	Hans Bruggemann	10537/126	4532

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EXAMINER	
NGUYEN, TU MINH	
ART UNIT	**PAPER NUMBER**
3748	

DATE MAILED: 04/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/885,626	BRUGGEMANN ET AL.	
	Examiner	Art Unit	
	Tu M. Nguyen	3748	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *25 March 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *14-16,19,20 and 26-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *14-16,19,20 and 26-35* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. An Applicant's Amendment filed on March 25, 2004 has been entered. Overall, claims 14-16, 19, 20, and 26-35 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office Action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 14-16, 19, 20, 26-28, and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Araki et al. (U.S. Patent 5,850,735) in view of Pinnavaia et al. (U.S. Patent 5,114,691).

Re claims 14, 15, 32, and 35, as shown in Figure 9, Araki et al. disclose an emission control system configured for use with an internal combustion engine (1) and a method for operating such system, the system comprises:

- a particle filter (93); and

- an arrangement disposed upstream from the particle filter and configured to at least reduce clogging of the particle filter by prevention of development of aluminum-containing sulfate ash upstream from the particle filter by one of transformation and maintenance of at least

one of the compounds responsible for sulfate ash formation in the gaseous state, the arrangement including:

- a device (coating layers of alumina on the surface wall of the exhaust gas passages of the filter (93)) configured to collect at least a portion of the sulfate ash-forming compounds of sulfur contained in the exhaust gas (during a lean operation of the engine, SOx in the exhaust gas is oxidized by the device to form ash-forming compounds (SO_3 and SO_4) of sulfur; SO_3 and SO_4 are then absorbed and collected onto the surface of the alumina layers (see lines 34-59 of column 15 and lines 5-16 of column 7)); and

- a device (91) configured to convert the collected sulfate ash-forming compounds of sulfur into gaseous compounds of sulfur that do not form ash (the oxidation catalyst (91) oxidizes the rich components in the exhaust gas so that the oxygen level in the exhaust gas is reduced and the temperature of the exhaust gas is raised to a level sufficiently high to maximize the transformation of the collected (SO_3 and SO_4) into gaseous compounds (SO_2) of sulfur (also see the Abstract)).

Araki et al., however, fail to disclose that in addition to alumina as a SOx absorbent, the coating layers on the surface wall of the exhaust gas passages of the filter (93) further comprise at least one of zinc, alkaline, and earth alkaline as a SOx absorbent.

Pinnavaia et al. teach a process of removing SOx from gas stream using heated layered double hydroxide (LDH) sorbents. It was found that a Mg_3Al LDH sorbent prepared with an alkaline-earth metal (Mg) and a transition metal (Fe) shows enhanced SOx conversion efficiency over that of a LDH which is not prepared with an alkaline-earth metal (see Table 2 and lines 37-44 of column 9). It would have been obvious to one having ordinary skill in the art at the time of

the invention was made, to have utilized a Mg_3Al LDH sorbent taught by Pinnavaia et al. in the system and method of Araki et al., since the use thereof would have increased SOx conversion efficiency.

Re claim 16, in the modified system of Araki et al., the arrangement includes a SOx collector (93).

Re claims 19 and 20, in the modified system of Araki et al., the arrangement includes an oxidation catalyst (91).

Re claims 26-28, in the modified system and method of Araki et al., the gaseous compounds of sulfur that do not form sulfate ash include SO_2.

Re claim 33, the modified method of Araki et al. further comprises the steps of:

- operating the emission control system in a normal operating phase with a lean exhaust composition to store sulfur contained in the exhaust gas; and

- operating the emission control system in a regeneration phase with a rich exhaust composition to release stored sulfur as at least one gaseous compound.

Re claim 34, in the modified method of Araki et al., the step of operating the emission control system in the regeneration phase includes the substep of raising an exhaust temperature to between 550°C and 700°C (lines 9-46 of column 10).

4. Claims 29 and 30, 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Araki et al. in view of Pinnavaia et al. as applied to claims 14 and 16, respectively, above, and further in view of Hirota et al. (U.S. Patent 6,233,927).

Re claims 29 and 30, the modified system of Araki et al. discloses the inventions as cited above, however, fails to disclose that the arrangement further includes an NOx collector.

As shown in Figure 5, Hirota et al. teach an exhaust gas purification device comprising a particle filter (7) that also absorbs SOx in the exhaust gas and a NOx collector (11) located upstream of the particle filter (7) to purify harmful NOx emissions in the exhaust gas. It would have been obvious to one having ordinary skill in the art at the time of the invention was made, to have utilized the NOx collector taught by Hirota et al. in the modified system of Araki et al., since the use thereof would have reduced the emission of harmful NOx gas into the atmosphere.

Re claim 31, in the modified system of Araki et al., the arrangement includes an oxidation catalyst (91).

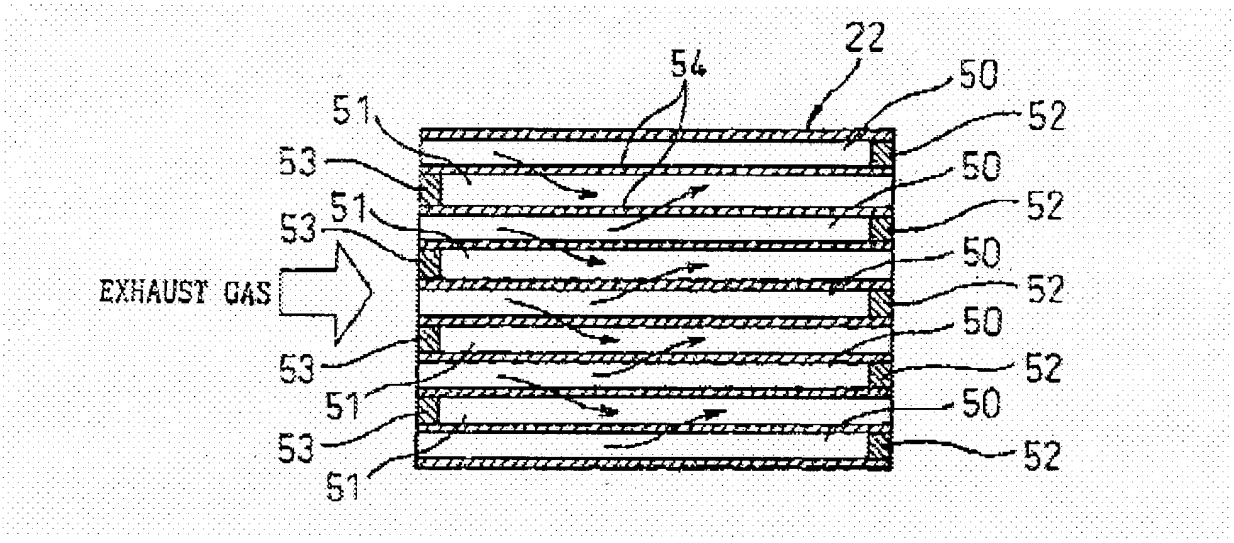
Response to Arguments

5. Applicant's arguments with respect to the references applied in the previous Office Action have been fully considered but they are not persuasive.

In response to applicant's argument that the rejections by using the combined references of Araki et al., Pinnavaia et al., and Hirota et al. are improper because none of the references discloses or teaches "an arrangement disposed upstream from the particle filter and configured to at least reduce clogging of the particle filter by prevention of development of sulfate ash upstream from the particle filter" (pages 7, 9, and 12 of Applicant's Amendment), the examiner respectfully disagrees.

As shown in Figure 9, Araki et al. disclose a particulate filter (93) having a dual function of trapping particulate matters and of absorbing and releasing SOx in the exhaust gas. As indicated on lines 39-59 of column 15, the particulate filter (93) has numerous exhaust gas

passages formed in parallel. This can be better illustrated by the figure shown below where the exhaust gas passages are labeled as "50" and "51". Approximately half of the passages are plugged at the upstream ends and the other half are plugged at the downstream ends. The exhaust gas flows into the filter through the passages having open upstream ends, and flows into the passages having downstream ends through the porous walls separating the exhaust gas passages from each other.



The particulate matters such as soot are trapped or collected by the porous walls (labeled as "54" in the above figure) of the filter. As aforementioned, the particulate filter (93) also has a function to absorb SOx. The porous walls of the filter (93) are coated with layers of alumina, silica, or titania adapted to absorb SOx in the exhaust gas. Since the exhaust gas in Araki et al. has to flow through the layers of alumina, silica, or titania first before flowing through the porous walls, it is clear that these layers are located at an upstream location from the porous walls of the particulate filter. The SOx in the exhaust gas is absorbed by these layers first and then the exhaust gas depleted of SOx can flow through the porous walls where the soot particles are

collected therein. Thus, Araki et al. clearly disclose "an arrangement (layers of alumina, silica, or titania) disposed upstream from the particle filter and configured to at least reduce clogging of the particle filter by prevention of development of sulfate ash upstream from the particle filter".

In response to applicant's argument that the cited references of Araki et al. and Pinnavaiaet al. teach away from the pending application by promoting the formation of sulfate on the filter; and that the cited references fail to transform or maintain one of the compounds responsible for sulfate ash formation in the gaseous state (pages 7-8 of Applicant's Amendment), the examiner again respectfully disagrees.

As shown in Figure 11 and indicated in the Abstract and on lines 8-27 of column 17, when the exhaust gas reaches a releasing temperature for the absorbed sulfate compounds, Araki et al. inject a fuel into an exhaust path to generate rich components (unburned HC) in the exhaust gas. These rich components are then oxidized by the oxidation catalyst (91) located upstream from the particulate filter (93) so that the oxygen level in the exhaust gas is reduced and the temperature of the exhaust gas is raised to a level sufficiently high to maximize the transformation of the absorbed solid state compounds of sulfur (SO_3 and SO_4) in the layers of alumina, silica, or titania into gaseous compounds of sulfur (SO_2). These gaseous compounds are easily passed through the filter without being trapped at the porous walls of the filter as those having a solid state such as SO_3 and SO_4. Therefore, Araki et al. clearly avoid promoting the formation of sulfate on the filter by transforming or maintaining at least one of the compounds responsible for sulfate ash formation in the gaseous state.

In response to applicant's argument that the cited references fail to disclose or render obvious "a device configured to convert the collected sulfate ash-forming compounds of sulfur

into gaseous compounds of sulfur that do not form ash" (page 9 of Applicant's Amendment), the examiner again respectfully disagrees.

The oxidation catalyst (91) in Araki et al. is considered to be such device since the oxidation catalyst (91) oxidizes the rich components in the exhaust gas to reduce an oxygen level and to raise an exhaust gas temperature such that the absorbed solid state compounds of sulfur (SO_3 and SO_4) in the layers of alumina, silica, or titania of the downstream filter (93) are transformed into gaseous compounds of sulfur (SO_2). Thus, Araki et al. clearly disclose "a device configured to convert the collected sulfate ash-forming compounds of sulfur into gaseous compounds of sulfur that do not form ash".

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Communication

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Tu Nguyen whose telephone number is (703) 308-2833.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Thomas E. Denion, can be reached on (703) 308-2623. The fax phone number for this group is (703) 308-7763.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-1148.

Tu M. Nguyen

TMN

April 16, 2004

Tu M. Nguyen

Patent Examiner

Art Unit 3748